DOCUMENT RESUME

ED 304 620 CG 021 494

AUTHOR Gottfredson, Gary D.
TITLE Explorations of Adolescent Drug Involvement.
SPONS AGENCY Department of Justice, Washington, D.C. Office of Juvenile Justice and Delinquency Prevention.
PUB DATE Aug 88
GRANT 87-JN-CX-0015
NOTE 90p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Adolescents; *Behavior Theories; *Drug Abuse; Secondary Education

ABSTRACT

The most important theoretical perspectives on adolescent drug use are probably those of Akers which use ideas from differential association theory and a variant of social learning theory; Oetting and Beauvais' peer group perspective; and the family perspective of Patterson and Dishion. This research involved an examination of stages of initiation into drug use, the properties of drug use measures, and the specificity versus generality of drug use and other forms of deviant behavior. It also involved empirical research to determine the extent to which drug involvement can be regarded as a construct distinct from other manifestations of delinquent behavior. This research used a subset of data previously collected on a cohort-sequential sample of secondary school students, collected from 1981-1983 as part of the School Action Effectiveness Study. These surveys measured an extensive array of parental, peer, and personal characteristics, including drug use and delinquency. Results imply that drug availability is an important determinant of individual drug involvement. Other implications include: (1) additional attention to basic psychometric theory and statistical methodology would be helpful in future research on the stepping stone perspective; (2) future research on school and environment as influences on adolescent drug use may have promise; and (3) variation from school to school in levels of drug use can be explained by the differences in the populations of students attending schools. Results also support the general deviance perspective and the drug specificity perspective. (ABL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED304620

Explorations of Adolescent Drug Involvement

Gary D. Gottfredson

Center for Social Organization of Schools
Johns Hopkins University

August 1988

CG 021494

This work was supported in part by grant number 87-JN-CX-0015 from the Institute for Juvenile Justice and Delinquency Prevention, U.S. Department of Justice. Opinions expressed are the author's and do not necessarily represent the position or policies of the U.S. Department of Justice.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Gary Gottfredson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Table of Contents

	Page
Theory in Drug Research	1
Specificity, Generality and Stages in Drug Behavior	4
Research Questions	6
Practical Applications--Theory in Preventive Intervention	9
The Present Research	13
The Primary Data	13
Research Design and Methods	19
Specificity vs. Generality and Stages of Drug Use	20
Examining the Influence of Availability on Drug Involvement	25
Results	27
Patterns of Progression into Drug Use	27
Scale Properties from a Classical True-Score Theory Perspective	32
Some Explorations of Stages of Initiation	37
Explorations of the Influence of Drug Availability	45
Discussion	49
References	52
Tables	61

Explorations of Adolescent Drug Involvement

This report describes research on selected issues in the measurement of drug involvement among adolescents and on the etiology of drug involvement. It takes as its primary point of departure, an examination of methodological issues in a "stepping stone" perspective on involvement with drugs and goes on to explore an alternative perspective--one that assumes that drug involvement reflects (a) an individuals propensity to adolescent problem behavior in general combined with (b) environmental influences that make drug involvement more or less likely. The results of these explorations suggest caution in interpreting results from research that has promoted the stepping stone perspective and provide support for an environmental influence perspective.

THEORY IN DRUG RESEARCH

The most influential theoretical perspectives on adolescent drug use are probably those of Akers (Burgess & Akers, 1966; Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979), Kandel (1980), Kaplan (1980), and Jessor & Jessor (1977). A new peer group perspective suggested by Oetting and Beauvais (1986) and the family perspective suggested by Patterson and Dishion (1985) may

be expected to become influencial as well.

Basically Akers uses ideas from differential association theory and a variant of social learning theory, Kandel concatenates ideas from social learning and social control perspectives with an emphasis on stages of involvement and on peer and parental influence, and Kaplan combines social interactionist ideas with a focus on derogated self-esteem as an impetus to deviance.

A broader set of relevant theoretical perspectives exist when one considers the entire area of deviant behavior. Hirschi's (1969) social control theory is influential and has generated considerable support (Hindelang, 1973; D. Gottfredson, 1982, G. Gottfredson, 1981; G. Gottfredson et al., 1983). Elliott, Ageton, & Canter (1979) have proposed a concatenation of differential association and control theory that has at least generated controversy (Gottfredson, 1982a; Hirschi, 1979). Gold (1978) has proposed a theory resembling Kaplan's that assumes experiences of failure in school are key in ravaging self-esteem. Labelling theory (Lemert, 1972) has had influence and generated controversy, criticism and mixed or ambiguous support (Hirschi, 1975; Klein 1981; Robins, 1975).

Oetting and Beauvais see other influences as mediated by

choices of peer groups which determine attitudes, values and beliefs, and therefore determine behavior. Last, Patterson, Loeber, and their associates (Patterson & Stouthamer-Loeber, 1984; Patterson & Dishion, 1985; Dishion & Loeber, 1985) see skill deficits leading to delinquent peer associations, and they ascribe direct causal status to parental monitoring and peer associations in the explanation of delinquent behavior.

The Oetting and Beauvais perspective implies that no intervention that does not alter peer associations will be effective. In contrast, Block et al. (1988, p. 351) suggested that, "Given the personality characteristics of our [longitudinally studied sample of] nursery school children, it seems to us no accident that, 10 years later, they have found like-minded friends . . . to be influenced by and to in turn influence" -- a suggestion similar to the birds-of-a-feather perspective of Hirschi (1969) and the Gluecks (1950).

The various theories provide a rich source of hypotheses, sometimes making convergent and sometimes divergent predictions. Replication and methodological improvements on previous research related to each of these perspectives is needed, as is research that aims to bring parsimony by by testing the relative utility of alternative conceptualizations.

Kandel's (1980) suggestion that the risk factors for initiation into different stages of drug use may differ, Gorsuch & Butler's (1976) suggestion that multiple models may be required to understand or predict drug use for different types of people, and the clear but untested predictions of interaction of self-esteem with other variables made in Kaplan's and Gold's theories imply that this model testing research is required. Kandel's perspective also implies statistical interactions requiring different models for different stages, but her own work (despite its influence) has not tested for interactions.

Specificity, Generality and Stages in Drug Behavior

The correlates of adolescent drug and alcohol use generally resemble the correlates of other illegal behavior (Donovan and Jessor, 1978; Empey, 1981; G. Gottfredson, 1981, 1987; Hirschi, 1969; Kandel, 1980; Robins, 1975). Interpretations of these commonalities differ. Some researchers (e.g., Hindelang, Hirschi, & Weis, 1981; Jessor & Jessor, 1977) regard illicit drug use as a form of generalized problem behavior. Others (e.g., Kandel, 1980; Johnston, O'Malley, & Eveland, 1978) ask if delinquency leads to drug use or if drug use leads to delinquency. This question implies that drug use and delinquent behavior are distinct.

Kandel, Kessler, & Margulies (1978) interpret their evidence as implying that involvement with alcohol, marihuana, and other drugs are successive stages in a progression and that different processes explain progression to successive stages. Kandel (1980) recommended the decomposition of samples into groups that have reached various stages in initiation into drug use in studying development.

In contrast, Jessor and Jessor (1978) and others (Block et al., 1988; Gottfredson, 1987) interpret the evidence as implying a general tendency to engage in problem behavior, and that the specific form the deviant behavior takes depends on environmental contingencies such as availability of drugs or social support or aprobation for that specific behavior. Similarly, the correlates of association with delinquent or drug using peers resemble the correlates of delinquency or drug using behavior (Hirschi, 1969; Gottfredson, 1982; Oetting & Beauvais, 1977). Oetting and Beauvais, Elliott et al. (1985), and Akers et al. (1979) regard delinquent/drug using peer associations as causes of delinquency/drug use; Hirschi (1969) and the Gluecks (1950) regard peer association as a "birds of a feather" phenomenon--an alternative indicator of delinquency rather than a cause of it.

Research Questions

A first set of research questions to be addressed is therefore: Is adolescent use of drugs specific or general? Is the sequencing of stages of initiation into drug use observed in some previous studies the same in areas where availability of drugs differs? Does the assumption that various kinds of drug use, alcohol and tobacco use, and other illegal behavior are alternative indicators of a single construct "deviance" fit the data better than an assumption that drug use is an independent construct? Is an approach that relies on the onset of drug use to examine stages of initiation into drug use more or less heuristic than an approach that regards extensiveness or variety of use as the important outcomes?

I hypothesize (a) that sequencing of "initiation" depends partly on environmental availability and that the regularities often observed reflect typical patterns in the availability of substances in adolescents' environments, (b) that use of some substances is more deviant than involvement in others and that the ladder-like patterns often observed are the result of more deviant expressions of a single underlying tendency, and (c) that the different processes observed at different stages are largely reflections of methodological artifacts resulting from partitioning the sample on the basis of the dependent variable or

measurement or sampling artifacts.

A second set of questions relates to the consequences of drug use for school performance. The research will explore these consequences by examining the correlates of variety of substance use with school attendance, effort, and other variables. I hypothesize that drug involvement is negatively correlated with these outcomes even when other personal and background variables (including non-drug related aspects of delinquency) are statistically controlled, but that most of the correlations are shared with a general predisposition to delinquency -- not unique to drug involvement.

It is important to learn whether stages of progression in drug use exist, with different processes of progression ad different stages (as suggested by some work of Kandel and her associates; see also Donovan & Jessor, 1983), or whether the specific patterns of substances used depends on a general risk of involvement combined with environmental availability and social support for the use of specific substances (as suggested by the Jessor and Jessor perspective and by the Kandel et al., 1978, results about the association of school with the use of "other illegal drugs").

Research that simultaneously examines personal risk and

environmental availability is required. Because the sequential stage notion focuses attention on the personal characteristics of persons at each stage that put them at risk of progression, whereas the general risk notion focuses attention on environmental and social control or facilitation influences, the results of research scrutinizing these ideas will have implications for the design of preventive interventions. Should we focus intervention efforts on environmental influences that shape the direction of behavior and on a general set of personal risk factors, or should we intervene to ameliorate specific risk factors for individuals at various stages of initiation into drug use?

Clarity about the most appropriate measurement models for drug-related behaviors is necessary to sensibly approach the task of developing models of the developmental process. Clarity about the measurement of drug use and illicit behavior and about the theoretical and empirical independence of personal behavior and association with deviant (drug using or delinquent) peers is required to select the criterion behavior to be prevented. For example, extensive involvement with drugs may reflect an extreme manifestations of a deviance syndrome.<1>

<1>McCord (1981) noted that the childhood and adolescent characteristics of alcoholics who are also criminals are more

Practical Applications--Theory in Preventive Intervention

A pressing need exists for theory that can be used to guide the development and assessment of preventive interventions. Gottfredson and his colleagues (Gottfredson, 1984; Gottfredson et al., 1984) and Empey (1980) have argued that theory should be used as a template for designing interventions, for chosing among alternative interventions, and assessing the strength and fidelity of interventions.

But current theory does not always converge on common causal variables. To extend the examples already offered, Winick's (1980) perspective on drug use assumes drug dependence will be high in groups where access to drugs is high, members are disengaged from proscriptions against drug use, and members experience role strain. This suggests interventions aimed at limiting the availability of drugs, fostering disapproval of drug use, and reducing role strain or increasing access to satisfying roles.

Other theories would suggest different kinds of interventions. For example, Ausubel's (1980) perspective suggests that narcotic addiction is explained by (a) the degree

---

like the characteristics of criminals than of alcoholics who are not criminals.

of access to narcotic drugs, (b) attitudinal tolerance in the individual's social milieu, and (c) personality characteristics including ego immaturity and an inability to defer gratification. Interventions guided by this perspective might seek to limit access to drugs, change tolerance of drug use in social environments, or foster personality maturation. The first two implications of Ausubel's perspective resemble the first two implications of Winick's perspective, but the third is quite different. Other theoretical perspectives imply still different interventions. Kaplan's (1980) perspective suggests building self-esteem, whereas Hirschi's (1969) perspective suggests strengthening attachments to others, commitment to conventional social goals, and belief in conventional social rules is important but that self-esteem and association with deviant peers may be irrelevant. In contrast, the Oetting and Beauvais (1976) perspective implies that blocking association with deviant peers is the key to prevention.

Each of these theories suggests not only some objectives to be sought in preventive intervention (and a set of irrelevant or spurious objectives or characteristics) but also the short-term (or intermediary) outcomes to be measured in evaluating those interventions.

The importance of identifying and assessing theoretically

relevant variables in intervention trials is illustrated by the Napa Drug Abuse Prevention Project (Schaps et al., 1984) which tested several interventions including inservice training for teachers in classroom organization and cross-age tutoring, among others. Most of these interventions failed to produce the hypothesized outcomes. That is they produced neither reductions in drug use nor changes in attitudes, perceptions, intentions, or behaviors.

Schaps et al. concluded that the interventions may have been ineffective because they were based on faulty theory (the theory that attention to affective needs will improve competencies and attitudes and thus lead to less drug involvement). It is more likely, however, that important parts of the theory were untested in the evaluation because the study provided ambiguous evidence about the intervention's effect on theoretically important intermediary variables. Specifically, because the interventions failed to alter attitudes, perceptions, intentions, and behaviors, the part of the chain which implies a link between these intermediaries and drug use was not tested by manipulation.

Furthermore, because an examination of correlational evidence from the Napa project did not show that the measure of self-esteem (for instance) used in this research was related to

drug use (in ways at least some other research has implied that self-esteem is related to drug use), even if the measure used had been influenced by the interventions it is not clear that the self-attitude part of the chain would have been tested.

To test theories about adolescent attitudes and perceptions believed to be causally related to drug involvment in field trials, measures of these adolescent characteristics which have been shown in research to behave as if they are causally related to drug involvement are required--as are interventions which alter these characteristics of adolescents.

The implications of the present research for the design and evaluation of drug use prevention interventions and their field trials are related to the foregoing simple ideas. Careful measurement and causal modeling research should provide more parsimonious theoretical models of drug involvement and a set of well-studied measurement procedures that can be used in field trials. The primary importance of fundamental research for preventive intervention is its likelihood of contributing to useful theory for guiding the choice of interventions and useful methods for determining whether given realizations of those interventions are achieving the intermediary outcomes necessary to reduce the risk of drug involvement.

THE PRESENT RESEARCH

This section provides a brief overview of the empirical research reported in the remainder of this report. More details on research methods or statistical procedures are presented together with results in subsequent sections.

The present research uses a subset of data previously collected on a cohort-sequential sample of secondary school students. The data used were collected from students surveyed in 1981, 1982, and 1983 as part of the School Action Effectiveness Study (SAES). Surveys of probability samples of students measured an extensive array of parental, peer, and personal characteristics, including drug use and delinquency.

The Primary Data

We began the SAES in 1980 to evaluate seventeen delinquency prevention projects sponsored by the U.S. Office for Juvenile Justice and Delinquency Prevention (OJJDP, 1980; Gottfredson, 1982b; Gottfredson, Gottfredson, & Cook, 1983). OJJDP supported prevention projects operated by the public schools or by community organizations which sought to reduce the risk of delinquency through primary or secondary prevention efforts. The theoretical premises for this prevention program and its

evaluation were drawn from notions of the key role of schooling in the development or amelioration of risk factors for drug involvement and other forms of deviance (Gottfredson, 1981), and from control theory (Hirschi, 1969); Gold's (1978) theory of school performance, self-esteem, and delinquency (a perspective that closely resembles Kaplan's, 1980, perspective); social learning theory (Bandura, 1977); labelling theory (Lemert, 1972); differential association theory (Sutherland & Cressey, 1978); a perspective implying the importance of person-environment interaction in the development and maintenance of behavior (Gottfredson, 1987a); and the expectation that parental and peer influences may be important causal variables.

We designed data collection instruments to collect information on the range of risk factors for delinquent behavior and drug use and on family structure. Accordingly, comprehensive data on the key theoretical variables from each of the foregoing perspectives as well as other known risk factors for delinquent behavior and drug use were obtained. The measures include information on various aspects of delinquent behavior, use of tobacco, alcohol, marihuana, and other drugs, extensive data on peer behavior and attitudes, parental behavior and attitudes, school performance, ability, family structure, availability of marihuana and other drugs in the school, and other aspects of the

school environments.

The OJJDP program operated in 69 schools in the first year of a three-year intervention effort. Four of the seventeen projects ceased operation after two years; however, and the project was operating in 51 schools in the 1982-83 school year. One project did not become involved directly with schools, and is excluded from the remaining discussion.

We had multiple aims in designing the data collection effort. We sought not only to evaluate the intervention efforts, but also to collect comprehensive data valuable in performing fundamental tests of prevention theory. For this reason, we developed measures of the characteristics and behaviors of representative members of the school populations and the school environments. We anticipated the value of longitudinal studies of youth development in the understanding of the life-course development of drug use and other proscribed behaviors in the design of the evaluation.

The result was a cohort-sequential design similar to that used by Jessor and Jessor (1978) and recommended by Riley & Waring (1978). In late April and early May of 1981, 1982, and 1983 samples of students were surveyed in each of the schools in which prevention projects were operating and in five

non-intervention schools.

The samples were drawn as follows: Each year all students currently (or who had in the past been) the subject of a direct intervention and their randomly equivalent or quasi-experimental controls were sampled with probability equal to 1.0. These students account for about 10% of the students in the sample. In 1982 and 1983 students who had completed surveys in a previous year and who were still enrolled in the same school or who had moved to another school in the study were also sampled with probability equal to 1.0. All other students enrolled in the school were randomly sampled with a probability that resulted in a target number of about 200 students in each school (for schools with at least 200 students) who were not recipients of direct interventions nor control group students. Therefore, for each year, the sample can be weighted to represent each school's population.

For those portions of the present research involving cross-sectional designs, students initially sampled with probability 1.0 were re-sampled in proportion to other students in their schools. This sampling strategy results not only in longitudinal data on individuals over the course of three years, but also a sequence of age-specific cross-sectional waves of data representative of students in each school.

For those portions of the research involving cross-sectional samples, junior/middle high school students in schools with sufficiently large half-samples to allow meaningful analyses (half samples of 24 respondents or more) were selected. These schools were located in Kalamazoo Michigan (2), the South Bronx (12), East Harlem (1), Ponce (PR, 2), the Virgin Islands (1), Plymouth (MI, 2), and St. Paul (2).

For those portions of the research involving longitudinal analyses, a different subset of the SAES student survey data were used. These analyses use data from surveys conducted in the spring of 1981, a year later in the spring of 1982, and in the spring of 1983. Included in the sample are students who participated in the 1982 administration who also participated in the 1981 or 1983 administrations. The sample includes students in grades 6 through 12; the sample is 42% black and 44% male. The longitudinal sample is described in great detail elsewhere (D. Gottfredson, 1985) where it is shown that despite its origins in a study of school efficacy in delinquency prevention program implementation and outcome achievement, and deliberate attempts to make the sample diverse, the sample resembles other national samples.

Survey measures. One set of measures are based on the voluntary self-reports of students in the annual surveys

described above. An attempt was made to keep the reading difficulty at the fifth-grade level or below according to the Flesch (1950) technique for the English version, and to write Spanish-language items in the simplest and most generally understandable way possible.<2>

Preliminary psychometric work has been described elsewhere (Gottfredson, 1982, 1985; Gottfredson, Gottfredson, & Cook, 1983). Briefly, a priori scales were subjected to internal consistency item analysis separately by sex for construction subsamples of Blacks, whites, and Spanish-speaking or Spanish-surnamed youths, and weak items were deleted. Reliabilities were estimated again in a hold-out sample of each race-sex subgroup to obtain unbiased estimates of reliability.

School and community environments. Steps were taken in the conduct of the SAES to collect comprehensive information about school characteristics, climates, and opportunities for drug use. We have distinguished between the measurement of individual characteristics and the measurement of environments

---

<2>Students who are Spanish-language dominant were provided with Spanish-language questionnaires. Items translated into Spanish were independently re-translated into English, and the retranslation was compared with the original English. Retranslated items judged to depart in meaning from the original were discussed with the translator and other native Spanish speakers and revised.

(see Richards, 1988). Aggregated student reports about their schools provide a basis for characterizing the schools in ways necessary for some of the present research. Most importantly, school measures of availability of drugs as well as extensiveness of drug use can be constructed.

RESEARCH DESIGN AND METHODS

This research involves an examination of stages of initiation into drug use, the properties of drug use measures, and the specificity versus generality of drug use and other forms of deviant behavior. It also involves empirical research to determine the extent to which drug involvement can be regarded as a construct distinct from other manifestations of delinquent behavior. This research initiates construct validation studies of a drug use measure by examining the extent to which it has unique associations with a range of other personal characteristics net of the association shared with non-drug delinquency and background characteristics. The brief six-month project period did not allow us to exhaust the potential of the data for this purpose.

Specificity vs. Generality and Stages of Drug Use

Sequencing of initiation. The sequence of initiation into use of various illicit drugs among members of different cohorts is interesting because of apparent shifts in the acceptance or use of these drugs. The proportion of persons who have tried marihuana has shot up (Abelson, Fishburne, & Cisin, 1977; Johnston, 1973); smoking (tobacco) seems to be declining in recent cohorts, however (Johnston, Bachman, & O'Malley, 1979). These shifts in usage among cohorts pose research questions and challenges. To examine whether or not the sequencing of initiation observed by Kandel and her associates (Kandel et al., 1978; Kandel & Faust, 1975) is observed in our data we have replicated her Guttman scale analysis methods.<3> We did this separately for schools where the availability of marihuana and

---

<3>Guttman scale analysis is described by Guttman (1944, 1950). We have reservations about this technique because of limitations noted by Clark and Kreidt (1948), Edwards (1948), Edwards and Kilpatrick (1948), Festinger (1947), Loevinger (1948), and Smith (1951), among others. The criterion of scalability can be met through a combination of two or more factors, rules for combining categories are arbitrary, reproducibility depends on the popularity of responses (with extreme splits reproducibility must be high) and it is easy to capitalize on chance. (Guttman, 1950, warned against using the technique when marginal splits are outside of the 20-80% range. When they are, the tail--i.e., rarely used substances--wags the dog.) Because some of these problems are addressed through replication with different samples, however, we shall nevertheless replicate the Kandel's use of the Guttman procedure.

other drugs differed (based on the aggregated reports of students in those schools).

Differences in rates of use of various substances by ethnicity in research by Johnson (1973) and Kleinman & Lukoff (1978) suggest that availability of different substances in the environment may indeed influence the progression, although this is by no means clear. Changes in availability or normative perceptions of use which change across cohorts may also result in shifts in ordering of initiation into use.

Unambiguous findings that usage of drugs has different orderings in environments where the availability of drugs of various kinds differs, different orderings for different cohorts, or findings of orderings substantially different from Kandel's would support the notion of generalized tendency to deviance. Such findings would suggest that environmental availability or social support determine the patterning of initiation to drug use and that the task of understanding the risk of drug involvement will be a simpler one than if persons and different stages must be understood using different models. A finding that usage of different drugs has Guttman "scale" properties and that the ordering is the same as found by Kandel and her colleagues would not necessarily support the notion that stages of initiation is a heuristic one, and that the task of understanding drug use

will be a complex one--involving the search for separate antecedents of initiation into the successive stages. Support for that perspective would also require a demonstration that some expected artifacts can not explain the seeming differences in processes at different "stages."

Other aspects of the stage versus generality notions. As discussed by Kandel, the notion of stages does not appear to mean that discontinuities exist in development or that progression is ultimately irreversable. The essential characteristics appear to be (a) the relative invariance in transition from substance to substance in earlier studies, and (b) different correlates of initiation into different drugs once the sample is partitioned into users and non-users of various substances (Kandel, Kessler, & Margulies, 1978). Here, as in forming Guttman scales in the first place, it is easy to capitalize on chance, especially when a large number of potential predictors of transition exist or where multicollinearity is a potential problem (as it usually is). We regard this second criterion for stages as a particularly risky one. A replicated finding of the same pattern of predictors in new data, for various cohorts, would provide much more impressive evidence of the stage model that do results currently available.

The methodological problems in discovering whether different

processes operate at different stages is not a straightforward one, however. The typical procedure used in past research has been to partition the sample into groups who have attained different stages in initiation into drug use, and this procedure is recommended by Kandel (1980) and also used by Kaplan (1980) in his research. But this form of selection of cases on the basis of a known correlate (predictor) of other forms of use is known to bias the coefficients estimated for a group. This problem of incidental selection on a dependent variable has long been described in methodological reference works (Gulliksen, 1950; Ghiselli, 1964) but it is often overlooked by researchers in the drug field.

The subdivision of a population on the basis of one type of drug use, known to be correlated with other types of drug use, biases regression coefficients so that there appear to be differences among groups.<4> To examine the hypothesis of

---

<4> In the econometrics literature this is known as the "censoring" problem, and Heckman (1975) has shown that selecting cases on the basis of a correlate of the dependent variable is akin to omitting from the statistical model a variable measuring the conditional probability that a case is included in the sample. Fligstein and Wolf (1978) building on this notion have suggested a technique (which itself may be problematical) of obtaining parameter estimates in a model when the criterion measures are available only for a subsample selected on a correlate of the criterion. Their technique involved including in the model a variable measuring the probability of the particular selection variable of interest to them (women's

different processes at different stages, researchers must search for statistical interactions.

Accordingly, the regression approach adoped by Kandel et al. (1978) is first replicated as closely as possible with the SAES data with the sample partitioned as in the earlier research using yearly prevalence data. Then what we regard as more appropriate models, which introduce previous initiation and interactions of previous initiation with other variables, are examined. In addition, probes of the posibility that measurement artifacts due to nonlinearity are made, and the robustness of the findings of heterogeneity of regression for different stages in different samples is explored. A clear pattern of findings of replicable statistical interactions not associated with nonlinear bivariate relations would lend support to a stage conceptualization. Failure to replicate would undermine the stage (or "stepping stone") hypothesis and imply that simpler stage-free models are adequate.<5>

---

participation in the labor force). The issue of appropriate methods to deal with the censoring problem is not resolved. But in drug research the problem is easier.

<5>Linear models, i.e. models that do not involve interactions or moderators, are usually more robust on cross validation that nonlinear models (Bentler and Eichberg (1975).

Examining the Influence of Availability on Drug Involvement

Robins' (1978) research on Vietnamese veterans suggests that the availability of drugs in Vietnam induced initiation to the use of marihuana and narcotics. Accordingly, the present rsearch examines whether drug use is influenced by the availability of these substances in the schools the students attended. Despite the difficulties inherent in contextual analyses (Hauser, 1970) this research examines the influence of substance availability in the schools these students attended on use of these substances. The hierarchical approach and methods described by Burstein (1980) are applied. The application of this hierarchical approach to delinquency data was recently discussed in more technical form by Gottfredson (1987b).

Briefly, the approach used decomposes a model of drug involvement that assumes individual differences in drug use are a function of (a) an additive constant, (b) a vector of community-level parameters associated with a set of community-level predictor scores, (c) error at the community level, (d) a vector of individual-level effect parameters associated with a set of individual predictor variables, and (d) error at the individual level. I test for the homogeneity of regression for the individual-level predictors among schools, and estimate the individual-level effect parameters based on the

pooled within school covariance matrix. That is the individual predictor parameters are estimated using deviations from each school's mean for the variables involved in the regressions. Then the school means for the individual-level predictors together with the parameters estimated in the previous step are used to adjust the school mean drug involvement for the compositional process, and the effects of availability measures at the school level on the deviations of mean drug involvement from that that can be accounted for by school composition is estimated in a second step.

Construction and validation samples. In the conduct of this research I have attempted to follow the logic of confirmatory analysis (James, Mulaik, & Brett, 1982). Exploratory work was done in random half-samples of the relevant groups, and true confirmatory analyses performed in half-samples held aside for this purpose. This procedure is intended to guard against substantive interpretation of chance outcomes.

Attrition and subject nonresponse are problems in all longitudinal research and much cross-sectional research (Josephson & Rosen 1978), and it will be a problem in the proposed research as well. Because of geographical mobility, and because of promotion from a junior high school participating in the SAES research to a high school not participating, for

example, persons completing surveys in one year were unavailable for in-school surveys in the next year. This mobility contributes to attrition, but about 80% of the persons in the 1982 sample who completed questionnaires in 1981 also completed questionnaires in 1982. Attrition differed in different locations due to uneven quality in survey administration at these locations. To probe the robustness of our results with differing degrees of attrition due to non-response, several analyses are presented with both pairwise and listwise deletion for missing data. The extremely brief project period precluded a more careful scrutiny of the issue of sampling and attrition.

RESULTS

Patterns of Progression into Drug Use

As explained earier, one perspective on drug use implies that use followes a predictable sequence of stages and that the point along this sequence at which one is located is of great importance, becuase the factors associated with risk of progression may be different from stage to stage. Table 1 shows the results of an examination of the percentage of middle/junior high school age students in each of 22 distinct schools who admit to having used each of six substances in the past year. One of

these, inhalants (glue, paint, or other spray, labeled "glue" in the table) was not included in Kandel and associates' earlier work. Despite some variation from school to school (part of which is due to sampling variability), alcohol tends to be the most used of the five substances, followed by tobacco, marijuana, inhalants, and other drugs.

The percentage using alcohol differs greatly from school to school--ranging from 22% to 59%. Similar variability in these rates are seen for cigarette use (5% to 45%), use of marijuana (5% to 28%), inhalants (1% to 29%), and other drugs (0% to 19%). Quite clearly, the base rates for the use of different substances tend to follow a similar rank order in the 22 schools despite school-to-school variation in the levels each is used. And clearly, some of the substances (inhalants and other drugs) have low base rates in most schools.

Table 1 illustrates why Guttman cautioned against the use of his method of scale analysis when the proportion endorsing a particular response is very small. The low base rate "tail" tends to wag the scale analysis "dog." In most reasearch applying the Guttman scaling procedure to drug use items, researchers have reported a <u>reproducibility</u> coefficient and a <u>coefficient of scalability</u>. Table 1 also reports the <u>minimum reporducibility</u> that is possible given the percentages using

each substance. The coefficieint of scalability shows the percentage of improvement in reproducibility as a percentage of improvement possible achieved over that achievable were the items not a scale in the Guttman sense. As readers can see, the minimum reproducibility was usually quite high, so the scalability coefficient is based on a fraction with a small denominator and high numbers are sometimes achieved by very slight improvements indeed. In general, however, a gambler would be well advised to attend to whether an adolescent admits smoking cigarettes in betting on whether that adolescent will admit to smoking marijuana.

The largest departure from the rank ordering of percentages of students using the five substances occurs for school 19, where more students report using inhalants than either tobacco or marijuana. Note that although the rank ordering (what Kandel and associates would call stages of initiation) is different for this school, the coefficients of reproducability and scalability are of about the same magnitude as coefficients for other schools. If the reproducability coefficients for other locations are taken as indicators of an "alcohol --> tobacco --> marijuana --> inhalant --> other" sequence, then the school 19 results imply that alcohol use leads to glue sniffing which leads to smoking cigarettes and marijuana.

Table 1 showed results for a random half of the students surveyed in each of these 22 schools--the exploratory sample. The other half sample of students provides a sense of how robust the results are. These confirmatory sample results are shown in Table 2. Despite a few schools where rather different results are produced for one half sample than for the other, the general pattern seen in Table 1 is seen again in Table 2. Glue sniffing is still suggested as a precursor to marijuana use for school 19.

Guttman scale analysis capitalizes on chance in the sense that it makes use of information about the base rate in establishing the ordering of "stages" in its ladder-like scales. The reproducibility coefficients shown in Tables 1 and 2 incorporate chance in this way. Based on a scrutiny of Table 1, it is possible to specify an ordering (alcohol, tobacco, marijuana, inhalants, other drugs) and to constrain an analysis to using this sequence. Results of this exercise are shown for the confirmatory sample in Table 3. The coefficients of reproducibility shown in Table 3 shows that in some cases, the data do not conform well to the sequence hypothesized. The sequencing does not improve on chance for school 10 and scarcely improves on it for school 12. Nevertheless, the summary of the distributions of Guttman scale statistics for the exploratory and confirmatory samples shown in Table 4 shows that the ordering

found in the exploratory sample is really quite robust.

These Table 1 through 4 results are also consistent with an interpretation that (a) all these items are indicators of a single underlying construct (tendency to use drugs), (b) that the probability of using specific drugs differs from location to location, and (c) persons with a greater tendency to use drugs have a higher probability of using each type of drug than do other adolescents in their respective schools. The attractiveness of this interpretation would be influenced by information about whether use of drugs in influenced by their availability and by information about whether these items form a scale in the traditional psychometric sense that they show evidence of being interpretable as a trait. Subsequent sections treat these matters.

The occasional deviation from the modal pattern (associated with different base rates for use of different substances in different schools) implies that, if there is a sequencing of initiation into different substances, the order of that sequence is not invariant. And if the use of inhalants is regarded as one step in a sequence (leading to use of other drugs), then our understanding of stages requires revision to incorporate this stepping stone. Kandel and Faust (1975) did not as they have claimed "provide unequivocal proof for the order in which various

drugs are used" (p. 924).

Scale Properties from a Classical True-Score Theory Perspective

This section examines the psychometric properties of a drug involvement scale composed in the traditional way--simply adding unit-weighted last-year self-reported drug use items together. This scale contains the five items examined in Tables 1 through 4, and adds an item asking whether the youth had gone to school drunk or high. This six-item scale has modest internal consistency reliabilities for exploratory sample males and females (.69 and .59, respectively). Reliabilities for the drug involvement scale and for several other composite measures examined in this section are presented in Table 5. Except for the delinquency scale, these other measures are discussed elsewhere (Gottfredson, 1982b; Gottfredson, 1985; Gottfredson et al., 1983).

Recall that some perspectives on drug involvement regard it as one aspect of general adolescent problem behavior, whereas other perspectives seek to create special theories of drug involvement based, for example, on a sequences of stages with different causal processes leading to succession from stage to stage. To the extent that drug involvement can be distinguished

in measurement from delinquency in general, or to the extent that it has special causes or consequences not shared with delinquency, the utility of the former perspective is diminished.

To examine these issues, a special delinquency scale composed of twelve items excluding items related in any way to drug involvement was examined. Specifically, the self-report delinquency scale contained items asking whether the youth had damaged or destroyed school property, damaged or destroyed other property, stolen or tried to steal something worth more than $50, carried a hidden weapon, been involved in gang fights, hit or threatened to hit a teacher or other adult at school, hit or threatened to hit other students, taken a car for a joyride, used force to take things from a person, stolen or tried to steal things worth less than $50, stolen things at school, or broken into a building or car. The alpha reliabilities for males and females are .82 and .67, respectively (Table 5).

The identity shown in equation 1 makes it possible to estimate the correlation between the true scores for the drug involvement and delinquency scales.

(1)

For males, this estimate is 1.08 and for females 1.09. These estimates are greater than 1.0 because alpha the alpha

coefficient provides a lower bound estimate for homogeneity (equivalent to the average of all possible split half coefficients stepped up to full length rather than the best split stepped up). Nevertheless, the application of this traditional test for the independence of two measures implies that the non-error components of these two scales measure pretty much the same underlying dimensions. By this criterion, then, regarding drug involvement as an alternative way of assessing general problem behavior appears to have utility.

Nevertheless, the exploratory sample results summarized in Table 6 imply that there is a tendency for drug involvement items to have slightly higher correlations with a composite of other drug items than with a composite of non-drug delinquency items. Although the correlations with the drug composite are not always higher than with the delinquency composite, and although the differences are usually small, the tendency is reasonably consistent and occurs despite the higher reliability of the longer delinquency scale. By this criterion, drug involvement appears closely related to non-drug delinquency, but its measurement as a specific special aspect of problem behavior could be useful. Parallel results for the confirmatory sample shown in Table 7 resemble those in Table 6, although they appear to provide less support for the distinctness of a drug

involvement measure.

Another way of exploring the utility of regarding drug involvement as distinct from general problem behavior is to determine with which other variables drug involvement shares variance not shared with delinquency and personal background variables. Table 8 shows that drug involvement is correlated with a range of other personal characteristics. Correlations with involvement in conventional activities, interpersonal competency, and parental education are trivial; but the correlations with other measures of adolescent problem behavior (delinquency, truancy, lack of effort at school work) are at least moderate.

To determine whether drug involvement is associated with other personal characteristics independently of variance shared with delinquency and background, a series of regression equations were evaluated. Specifically, each personal characteristic (other than delinquency, ethnicity, and parental education) with which drug involvement had a nontrivial zero-order correlation was regressed on background variables (ethnicity and parental education), delinquency, and drug involvement in stages. A significant increment to variance in the criterion variable when drug involvement is added to the regression model indicates a unique association of drug involvement with that criterion net of

the extent to which that criterion shares variance with the delinquency measure.

Results for males and females in the exploratory sample are shown in Tables 9 and 10. Drug involvement is uniquely associated with self-reported truancy for both males and females, and the association is not trivial ranging from an estimate of 1.2% to 2.4% for females (depending on how missing data are handled in the regression analyses) and 4.1% to 5.6% for males. Put another way, these results imply that around 4% to 6% of the variance in truancy is associated with drug involvement beyond the extent to which individual differences in truancy can be accounted for by ethnicity, parental education, and general delinquency. Drug involvement is also uniquely associated with attachment to school for females in one analysis.

Confirmatory sample results (with listwise deletion for missing variables) are shown for both males and females in Table 11. Drug involvement is again uniquely associated with truancy (4.6% of the variance in truancy uniquely associated with drug involvement for males and 7.0% for females). The unique association of drug involvement with attachment to school is replicated for both males and females in the confirmatory sample. A significant unique association with school effort is shown for the female confirmatory sample, a result not replicated in any of

the other analyses.

These results imply that regarding drug involvement as a personal characteristic distinct from general delinquency may have utility in explaining truancy and lack of attachment to school or in understanding the consequences of truancy and lack of attachment to school. (These analyses do not address causal sequences.) Drug involvement and truancy are related to each other and potentially to other variables beyond the extent to which each is related to nondrug delinquent behavior according to the Table 9 through 11 results.

Some Explorations of Stages of Initiation

Kandel et al. (1978, p. 77) have argued as follows:

> The identification of cumulative stages in drug behavior has important methodological implications for studying the factors that relate to drug use. Users of a particular drug must be compared, not to all nonusers, but only to nionusers among the restricted group of respondents who have already used drug(s) at preceding stage(s). Otherwise, the attributes identified as apparent characteristics of a particular class of drug users may actually reflect characteristics important for involvement in drugs at the preceding stages.

On the strength of this reasoning, Kandel and her associates recommend partitioning the sample examined in research and conducting a separate search for the correlates of initiation

into different "stages," which stages are presumably viewed as distinct rather than as different degrees of expression of a single trait. This seems to be so despite the evidence aduced by Kandel and her associates that drug involvement measures show Guttman-scale properties and other evidence that reasonably homogeneous scales based on the self-reported use of a variety of substances can be developed.

Kandel et al. (1978) examined the correlates of initiation into use of alcohol (hard liquor) for a pooled sample of adolescent boys and girls who had not earlier used tobacco or hard liquor, initiation into use of marijuana (for persons already "initiated" into hard liquor), and into the use of other illicit drugs (for adolescents already "initiated" into marijuana). Based on these separate examinations, Kandel et al. reported the following kinds of results with respect to parental influences, for example: "It is as role models that parents influence adolescent initiation to hard liquor" (p. 86).<6> In contrast, "parental influences on adolescent marihuana use are quite small" (p. 87). But, "parental influences on initiation

---

<6>This interpretation is based on a finding that fathers or mothers frequent use of hard liquor is correlated with adolescent use of hard liquor; this interpretation ignores that possibility that parental frequent use is correlated with adolescent use simply because of the opportunity to use that the availability of liquor around the house may provide.

into the use of illicit drugs other than marihuana are strong, especially the quality of the adolescent-parent relationship" (p. 88).

The introduction to this report spelled out the general nature of the methodological worries prompted by a suggestion that researchers ought to partition their sample on the basis of prior drug use in examining the separate causes of initiation into different "stages" of drug involvement. To reiterate, partioning the sample on the basis of the dependent variable or on the basis of a variable correlated with it is known to attenuate correlations and regression coefficients when the predictor-criterion distribution is bivariate normal (Gulliksen, 1950).<7> Furthermore, correlation and regression coefficients always wobble around a bit from sample to sample, and it is quite possible that differences from one subsample to the next are simply the result of chance.

In addition, what Kandel and her associates have suggested appears equivalent to implying that the regression of degree of "progression" into drug involvement is not linearly related to the various predictors (theoretical explanatory variables) or

---

<7>When distributions have a positive skew--as does the distribution of drug involvement--variance can increase with the level of the variable.

that there is a statistical interaction between the various predictors and the use of specific substances in the prediction of other specific substances. If Kandel et al. conducted the appropriate tests for statistical interactions, they did not report them before making interpretations of their results, and there is no sign that they examined the shape of the regression of drug use on the various predictors they examined.

Issues of selection, nonlinearity, and heterogeneity of regression are examined with data in the remainder of this section.

Correlations between the use of marijuana at time 2 (spring 1982) and with the drug involvement scale previously described are shown separately (a) for adolescents who had reported the use of alcohol or cigarettes at time 1 (spring 1981) and (b) for the entire sample of adolescents (regardless of alcohol or tobacco use at time 1) in Table 12 for males and Table 13 for females. Because both alcohol and tobacco use are correlates of marijuana use (and of course of the drug involvement scale), selection on the basis of these variables constitutes indidental selection on the basis of the criterion as described by Gulliksen (1950). In this particular case, the effects of incidental selection are not as straightforward as they would be in the case of variables sharing a bivariate normal distribution. Drug involvement has a

marked positive skew. In such cases, selection on the basis of the dependent variable can increase (rather than decrease) the standard deviation of the criterion variable; and this is the case here as Tables 12 and 13 show.

Notice that the magnitudes and significance of correlations between the various time 1 predictors and marijuana use at time 2 are often different for the unselected sample and the sample with incidental selection of the criterion variable. For instance, in the selected sample, parental education correlates .24 ($p < .01$) with marijuana use for males and .21 ($p < .01$) for females. These correlations are higher than in the unselected sample. In contrast, the correlation of marijuana use with attachment to school is somewhat higher in the unselected sample than in the selected sample for both boys and girls. It is presumably differences of this kind that Kandel and associates believe researchers should seek to find.

Making interpretations of differences in predictors in different samples should require that researchers demonstrate that (a) a similar pattern of differnces occurs on replication, (b) that the differneces are not due to measurement artifacts (such as nonlinearity), and (c) that the differences are significant--i.e., that there are statistically significant interactions of the predictors with the classificatory variable.

There is clear reason to worry about replicability. The parental education correlation does not replicate the Kandel et al. (1978) result. In their results for a sample selected on prior alcohol or tobacco use, father's education correlated .02 with marijuana "initiation" in a boy-girl sample.

Tables 14 and 15 for boys and girls, respectively, illustrate a conventional approach to testing for a statistical interaction of the classificatory variable (alcohol or tobacco use at time 1) with other predictor variables. These tests are not conservative, because they are not independent and there are so many of them, but a high proportion of them are statistically significant. From a scientific (theoretical) point of view, the large number of significant interactions is problematic. There are two reasons for this: (1) No theory predicts all these interactions. (2) Only a few of these interactions occur for both the male and the female sample; most do not replicate in both samples. What could account for the interactions that do replicate?

One possibility is a nonlinear bivariate relation between predictor and criterion. Table 16, which shows results for those variables with significant interactions in both the male and female samples, shows that most of these bivariate relations are characterized by nonlinearity.

The nature of the nonlinearities for each of the five predictors contained in Table 16 are shown in the top panels of Tables 17 through 21. For example, both male and female marijuana use was nonlinearly related to parental education. Marijuana use is greatest for girls whose parents have moderate (not very high or very low) education; for boys the pattern is more difficult to describe. And for both males and females marijuana use was nonlinearly related to school punishment. For both sexes, moderate levels of punishment (not very high or very low punishment) are associated with most marijuana use--although the peak has a different location for boys and girls.

If these nonlinearities are robust, they should be observed on replication in other data. The bottom panels of Tables 17 through 21 show the bivariate distributions for boys and girls with the predictors measured at time 2 (spring 1982) and with marijuana use measured at time 3 (spring 1983). Although somewhat tedious to relate, the results are as follows:

Parental education.

For males, the highest rates of marijuana use occur for the second highest parental education level in both analyses, and in both analyses the distribution is somewhat bimodal with a minor peak at parental education level 3.

For females, in both analyses the peak marijuana use occurs at parental education level 5--the distributions have a high point near the middle of the parental education range.

Belief in conventional rules.

Boys scoring at the bottom of the belief distribution do not use marijuana at highest rates in either of the two analyses, as they would were marijuana use a decreasing monotonic function of belief.

In both analyses for girls, the data also do not show a marijuana use to be a decreasing monotonic function of belief, although neither the peak use nor the minimum use occur at the same level of belief in the two analyses.

Interpersonal competency.

For boys, the 1981-82 analysis show marijuana use increasing from low to moderate levels of interpersonal competency and leveling off from moderate to high levels of interpersonal competency. This result is not replicated in the 1982-83 analysis.

For girls the 1981-82 data show a U-shaped relation between interpersonal competency and marijuana use, a result not replicated in the 1982-83 data.

Positive self-concept.

For boys, marijuana use is highest in the middle of the self-concept range in both samples.

For girls, marijuana use is highest at the second to the lowest part of the self-concept range in both analyses.

School punishment.

For boys, marijuana increases with punishment through the first three levels, and then falls off for the 25 boys receiving most punishment in the first set of analyses. In the second set, the pattern is similar but marijuana use falls off only very slightly for the 14 boys in the highest punishment category.

For girls, the marijuana use is markedly higher for the second level of school punishment than for the other levels in the first analysis, whereas it is a monotonically increasing function of punishment in the second analysis.

The main conclusion to be drawn from the examinations of statistical interactions and nonlinearities is that most of the interactions and nonlinearities are not seen in the same form in

different samples or successive waves of data, suggesting extreme caution in their interpretation in any particular sample.

Explorations of the Influence of Drug Availability

One perspective on drug use implies that use is a function of (a) individual differences in the propensity to deviance--including drug use--and (b) the availability of suitable substaces to use. According to this perspective, a general tendency to problem behavior or deviance will be manifested in those specific behaviors the individual has the opportunity to display because of the availability of suitable objects (e.g., a car to steal) or drugs (e.g., marijuana to buy). According to this perspective, for a given level of individual propensity, use is greater the greater the availability. An adolescent with moderate restraints against misconduct may smoke marijuana if it is offered in a social setting but would not seek out a seller in a strange location. In contrast, an adolescent with high restraints against misconduct would refuse the offer of a smoke, and an adolescent with low restrainsts might seek marijuana to buy in a strange location.

This perspective implies that the extent of drug use and the specific substances used will depend on their availability in the environments youths inhabit. The influence of drug availability

is the subject of the explorations in this section. Specifically, the research results reported here bear on whether differences among schools in drug availability influence individual student use of drugs.

A search for school availability effects on individual drug use presupposes that there are differences in levels of drug use among schools--that all the variability in drug use is not just individual differences in behavior within schools. Table 22 shows that between 6 and 13 percent of the variance in individual drug involvement lies between schools, depending on which sample is examined. There is substantial between-school variance in drug involvement to examine, so the question of the influence of school availability is a viable one.

The hierarchical method described earlier in the section on research design and methods was applied to data from the exploratory and confirmatory samples of males and females. The research proceded in the following stages:

First, the research was simplified by constructing a single variable to represent propensity to drug use by using construction sample data and stepwise regression to build--separately for males and females--a regression equation to predict drug involvement scores from a small set of other data

about the individuals. For both males and females, this resulted in equations in which nondrug delinquency was the most potent predictor, with Attachment to Parents, and age also included. Table 23 shows the correlations between this composite separately for males and females in the exploratory (construction) sample. Table 23 also shows the correlations between the composite derived in the exploratory sample when applied to the confirmatory (cross-validation) sample's data. Finally, the table shows the correlation between a composite developed in the confirmatory sample and drug involvement in that same sample. The composite developed in the exploratory sample is robust, performing better in the cross-validation sample than in the construction sample and almost as well as a new equation developed in the confirmatory sample. All analyses use the construction sample equations.

Second, tests for heterogeneity of regression were conducted by testing for the significance of the increment to explained variance when a vector of school-dummy-by-propensity crossproducts was added to an equation containing propensity and a vector of school dummies. These tests failed to reject the hypothesis of homogeneity of regression for either males or females.

Third, the equation for the pooled within school regression

of drug involvement on the propensity composite was calculated.

Fourth, the results of this regression were applied to school-level aggregate data to estimate equations relating school-level availability measures (based on the aggregated reports by both male and female students of how easy it is to buy marijuana and other drugs in the school and on the proportion of students who reported that they had sold drugs in the school) to drug involvement adjusted for the amount of use expected based on the propensity of the average male and female student.

The school-level correlations among the three measures of availability were high, supporting the construction of an availability scale at the school level. The multi-level equations showing the influence of both individual propensity and school availability on drug use using the availability scale are shown in Table 24. Individual propensity is a strong influence on use according to the models shown here in both exploratory and confirmatory samples for both males and females. In the confirmatory samples, the coefficents for school availability approach conventional significance levels (1.83 and 1.94 times the standard errors estimated in the school-level model), but they do not approach significance in the exploratory sample.

The best availability predictor of drug use in the

school-level model was not the composite availability scale, but the aggregated student reports that it was easy to buy drugs (other than marijuana) at the school. The multi-level equations using this measure are shown in Table 25. In three out of four instances, the availability measure achieves conventional significance levels--despite the small number of schools involved in the analyses.

These results imply that drug availability is an important determinant of individual drug involvement.

DISCUSSION

One implication of the present set of results is that the task of probing natural variation in individual characteristics and the use of drugs is complex. In particular, additional attention to basic psychometric theory and statistical methodology would be helpful in future research on the stepping stone perspective.

A second implication of the results is that future research on school and other environments as an influence on adolescent drug use may have promise. The results of the multi-level models examined here imply that drug availability contributes to drug use net of the characteristics of the students attending a

school. Results imply that reductions in drug use and truancy might be accomplished by steps to reduce the availability of drugs in schools even if nothing were done to improve the socialization of the students.

A third implication is that much of the variation from school to school in levels of drug use can be explained by the differences in the populations of students attending schools. Schools with many students who are delinquent will tend to have more extensive drug use than schools with less delinquent students.

Finally, the results lend support both to the general deviance perspective and to the drug specificity perspective. The general deviance perspective is supported by (a) the item analyses that show drug use items to be about as good as measures of non-drug delinquency as of drug involvement, (b) the very high correlation between true scores for drug involvement and delinquency, and (c) the multi-level results implying that individual drug use is a joint function of individual propensity and environmental availability of drugs. The specificity perspective is supported by (a) the item analyses that show drug use items to be slightly better as measures of drug involvement than of non-drug delinquency and (b) the regression results showing drug involvement to be associated with truancy beyond the

extent to which truancy is predictable from delinquency and personal background measures.

REFERENCES

Abelson, H. I., Fishburne, P. M., & Cisin, I. (1977). National survey on drug abuse: 1977 (Volume I: Main findings). Princeton, NJ: Response Analysis.

Akers, R. L., Krohn, M. D., Lanza-Kaduce, L., Radosevich, M. (1979). Social learning and deviant behavior: A specific test of a general theory. American Sociological Review, 44, 635-655.

Ausubel, D. P. (1980). An interactional approach to narcotic addiction. In D. J. Lettieri, M. Sayers, & H. W. Pearson (eds.), Theories of drug abuse: Selected contemporary perspectives (NIDA Research Monograph 30). Washington, DC: U.S. Government Printing Office.

Bandura, A. (1977). Social learning theory. Englewood Cliffs, NJ: Prentice-Hall.

Bentler, P. M., & Eichberg, R. H. (1975). A social psychological approach to substance abuse construct validity: Prediction of adolescent drug use from independent data. In D. J. Lettieri (Ed.), Predicting adolescent drug abuse: A review of issues, methods and correlates (pp. 131-145). Washington, DC: U.S. Government Printing Office.

Block, J., Block, J. H., & Keyes, S. (1988). Longitudinally foretelling drug usage in adolescence: Early childhood personality and environmental precursors. Child Development, 59, 336-355.

Brook, J., Lukoff, I. F., & Whiteman, M. (1979). Family socialization and adolescent personality and their association with adolescent use of marijuana. Journal of Genetic Psychology, 133, 261-271.

Burgess, R. L, & Akers, R. L. (1966).
A differential association-reinforcement theory of criminal behavior. Social Problems, 14, 128-47.

Burstein, L. (1980).
The analysis of multi-level data in educational research and evaluation. Review of Research in Education, 8, 158-233.

Clark, K. E., & Kreidt, P. H. (1948).
An application of Guttman's new scaling technique to an attitude questionnaire. Educational and Psychological Measurement, 8, 215-223.

Dishion, T. J., & Loeber, R. (1985).
Adolescent marijuana and alcohol use: The role of parents and peers revisited. American Journal of Drug and Alcohol Abuse, 11, 11-25.

Donovan, J. E., & Jessor, R. (1978).
Adolescent problem drinking. Journal of Studies on Alcohol, 39, 1506-1524.

Donovan, J. E., & Jessor, R. (1983).
Problem drinking and the dimension of involvement with drugs: A Guttman scalogram analysis of adolescent drug use. American Journal of Public Health, 73, 543-551.

Edwards, A. L. (1948).
On Guttman's scale analysis. Educational and Psychological Measurement, 8, 313-318.

Edwards, A. L., & Kilpatrick, F. P. (1948).
Scale analysis and the measurement of social attitudes. Psychometrika, 13, 99-114.

Elliott, D. S., Ageton, S. S., & Canter, R. J. (1979).
An integrated theoretical perspective on delinquent behavior. Journal of Research in Crime and Delinquency, 16, 2-27.

Elliott, D. S., Huizinga, D., & Ageton, S. S. (1985).
Explaining delinquency and drug use. Beverly Hills, CA: Sage.

Empey, L. T. (1980).
Field experimentation in criminal justice: Rationale and design. In M. W. Klein & K. S. Teilmann (eds.), Handbook of criminal justice evaluation. Beverly Hills, CA: Sage.

Empey, L. T. (1981).
Constructing crime: Evolution and implications of sociological theory. In S. E. Martin, L. B. Sechrest, & R. Redner (eds.), New directions in the rehabilitation of criminal offenders. Washington, DC: National Academy Press.

Festinger, L. (1947).
The treatment of qualitative data by "scale analysis." Psychological Bulletin, 44, 1949-161.

Flesch, R. (1950).
How to test readability: Measuring the level of abstraction. Journal of Applied Psychology, 34, 384-390.

Fligstein, N., & Wolf, W. (1978).
Sex similarities in occupational status attainment: Are the results due to restriction of the sample to employed women? Social Science Research, 7, 197-212.

Ghiselli, E. E. (1964).
Theory of psychological measurement. New York: McGraw-Hill.

Glueck, S., & Glueck, E. T. (1950).
Unraveling juvenile delinquency. Cambridge, MA: Harvard University Press.

Gold, M. (1978).
Scholastic experiences, self-esteem, and delinquent behavior. Crime and Delinquency, 24, 290-308.

Gorsuch, R. L., & Butler, M. C. (1976).
Initial drug abuse: A review of predisposing social psychological factors. Psychological Bulletin, 83, 120-137.

Gottfredson, D. C. (1982).
Personality and persistence in education: A longitudinal study. Journal of Personality and Social Psychology, 43, 532-545.

Gottfredson, D. C. (1985).
Youth employment, crime, and schooling: A longitudinal study of a national sample. Developmental Psychology, 21, 419-432.

Gottfredson, G. D. (1981).
Schooling and delinquency. In S. E. Martin, L. B. Sechrest, & R. Redner (eds.), New directions in the rehabilitation of criminal offenders. Washington, DC: National Academy Press.

Gottfredson, G. D. (1982a).
Role models, bonding, and delinquency: An examination of competing perspectives (Report No. 331). Baltimore: Center for Social Organization of Schools. (ED 230 888)

Gottfredson, G. D. (ed.). (1982b).
The school action effectiveness study: First interim report (Report No. 325). Baltimore: Johns Hopkins University, Center for Social Organization of Schools. (ED 222 835)

Gottfredson, G. D. (1984).
A theory-ridden approach to program evaluation: A method for stimulating researcher-implementer collaboration. American Psychologist, 39, 1101-1112.

Gottfredson, G. D. (1985).
Effective Schools Battery: User's Manual. Odessa, FL: Psychological Assessment Resources.

Gottfredson, G. D. (1987a).
American education -- American delinquency. Today's Delinquent, 6, 5 - 70.

Gottfredson, G. D. (1987b, November).
Methodological issues in estimating multilevel models. Paper presented at the annual meeting of the American Society of Criminology, Montreal.

Gottfredson, G. D., Gottfredson, D. C., & Cook, M. S. (1983).
The School Action Effectiveness Study: Second interim report (Report No. 342). Baltimore: The Johns Hopkins University, Center for Social Organization of Schools.

Gottfredson, G. D., Rickert, D. E., Gottfredson, D. C., &Advani, N. (1984).
Standards for Program Development Evaluation.
Psychological Documents, 14, 32. (Ms. 2668)

Gulliksen, H. (1950).
Theory of mental tests. New York: Wiley.

Guttman, L. (1944).
A basis for scaling qualitative data. American Sociological Review, 9, 139-150.

Guttman, L. (1950).
Problems of reliability. In D. A. Stouffer, et al. (eds.), Measurement and prediction. Princeton, NJ: Princeton University Press.

Hauser, R. M. (1970).
Context and consex: A cautionary tale. American Journal of Sociology, 75, 645-664.

Heckman, J. J. (1975).
Shadow prices, market wages and labor supply. Econometrica, 42, 679-694.

Hindelang, M. J. (1973).
Causes of delinquency: A partial replication and extension. Social Problems, 20, 471-487.

Hindelang, M. J., Hirschi, T., & Weis, J. G. (1981).
Measuring delinquency. Beverly Hills, CA: Sage.

Hirschi, T. (1969).
Causes of Delinquency. Berkeley: University of California Press.

Hirschi, T. (1975).
Labelling theory and juvenile delinquency: An assessment of the evidence. In W. R. Gove (ed.), The Labelling of deviance: Evaluating a perspective. New York: Halsted.

Hirschi, T. (1979).
Separate and unequal is better. Journal of Research in Crime and Delinquency, 16, 34-38.

James, L. R., Mulaik, S. A., & Brett, J. M. (1982).
Causal analysis: Assumptions, models, and data. Beverly Hills: Sage.

Jessor, R., & Jessor, S. L. (1977).
Problem behavior and psychosocial development: A longitudinal study of youth. New York: Academic Press.

Jessor, R., & Jessor, S. L. (1978).
Theory testing in longitudinal research on marihuana use. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Kandel, D., & Faust, R. (1975).Sequence and stages in patterns of adolescent drug use. Archives of General Psychiatry, 32, 923-932.

Johnson, B. D. (1973).
Marijuana users and drug subcultures. New York: Wiley.

Johnston, L. D. (1973).
Drugs and American youth. Ann Arbor, MI: Institute for Social Research.

Johnston, L. D., Bachman, J. G., & O'Malley, P. (1979).
1979 highlights: Drugs and the nation's high school students--Five year national trends. Rockville, MD: National Institute of Drug Abuse.

Johnston, L. D., O'Malley, P. M., & Eveland, L. K. (1978).
Drugs and delinquency: A search for causal connections. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Josephson, E., & Rosen, M. A. (1978).
Panel loss in a high school drug study. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Kandel, D. B. (1980).
Drug and drinking behavior among youth. Annual Review of Sociology, 6, 235-285.

Kandel, D. B., Kessler, R. C., & Margulies, R. Z. (1978).
Antecedents of adolescent initiation into stages of drug use: A developmental analysis. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Kaplan, H. B. (1980).
Deviant behavior in defense of self. New York: Academic Press.

Klein, M. W. (1981).
A judicious slap on the wrist: Thoughts on early sanctions for juvenile offenders. In S. E. Martin, L. B. Sechrest, & R. Redner (eds.), New directions in the rehabilitation of criminal offenders. Washington, DC: National Academy Press.

Kleinman, P. H., & Lukoff, I. F. (1978).
Ethnic differences in factors related to drug abuse. Journal of Health and Social Behavior, 19, 190-199.

Lemert, E. M. (1972).
Human deviance, social problems, and social controls (2nd edition). Englewood Cliffs, NJ: Prentice Hall.

Loevinger, J. (1948).
The technique of homogeneous tests compared with some aspects of "scale analysis" and factor analysis. Psychological Bulletin, 45, 507-529.

McCord, J. (1981).
Alcoholism and criminality: Confounding and differentiating factors. Journal of Studies on Alcohol, 42, 739-748.

Oetting, E. R., & Beauvais, F. (1986).
Peer cluster theory: Drugs and the adolescent. Journal of Counseling and Development, 65, 17-22.

Oetting, E. R., & Beauvais, F. (1987).
Peer cluster theory, socialization characteristics, and adolescent drug use: A path analysis. Journal of Counseling Psychology, 34, 205-213.

Office of Juvenile Justice and Delinquency Prevention. (1980).
Program announcement: Delinquency prevention through alternative education. Washington, DC: OJJDP.

Patterson, G. R., & Dishion, T. J. (1985).
Contributions of families and peers to delinquency. Criminology, 23, 63-80.

Patterson, G. R., & Stouthamer-Loeber, M. (1984). The correlation of family management practices and delinquency. Child Development, 55, 1299-1307.

Richards, J. M., Jr. (1988, August). Methods for environmental assessment and the individual differences fallacy. Paper prepared for presentation at the annual meeting of the American Psychological Association, Atlanta, GA.

Riley, M. W., & Waring, J. (1978). Age, cohorts, and drug use. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Robins, L. N. (1974). The Vietnam user returns (Final report, Special Action Office Monograph Series A, No. 2). Washington, DC: U.S. Government Printing Office.

Robins, L. N. (1975). Alcoholism and labelling theory. In W. R. Gove (ed.), The labelling of deviance: Evaluating a perspective. New York: Halsted.

Robins, L. N. (1978). The interaction of setting and predisposition in explaining novel behavior: Drug initiations before, in, and after Vietnam. In D. B. Kandel (ed.), Longitudinal research on drug use: Empirical findings and methodological issues. New York: Halsted.

Schaps, E., Moskowitz, J., Malvin, J., & Schaffer, G. (1984). The Napa drug abuse prevention project: Research findings (ADM 84-1339). Washington, DC: National Institute on Drug Abuse.

Smith, R. G., Jr. (1951). "Randomness of error" in reproducible scales. Educational and Psychological Measurement, 11, 587-596.

Sutherland, E. H., & Cressey, D. R. (1978). Criminology. Philadelphia: Lippincott. (1972).

Winick, C. (1980). A theory of drug dependence based on role, access to, and attitudes toward drugs. In D. J. Lettieri, M. Sayers, & H. W. Pearson (eds.), Theories on drug abuse: Selected contemporary perspectives (NIDA Research Monograph 30). Washington, DC: U.S. Government Printing Office.

Table 1

Percentages of Students Using Substances in Different Schools and Guttman Scale Analysis Results, Exploratory Sample

School	N	Order and percent involved					Repro.	Min. repro.	Coef. scal.
01	101	Alc.	Cig.	MJ	Other	Glue			
		59	45	28	12	4	.93	.74	.72
02	101	Alc.	Cig.	MJ	Glue	Other			
		40	23	16	10	6	.89	.81	.43
03	72	Alc.	Cig.	MJ	Glue	Other			
		33	29	24	3	0	.92	.82	.53
04	40	Alc.	Cig.	MJ	Glue	Other			
		40	25	15	8	5	.93	.82	.62
05	31	Alc.	Cig.	MJ	Glue	Other			
		16	16	13	6	3	.96	.89	.65
06	60	Alc.	Cig.	MJ	Glue	Other			
		20	7	3	2	2	.98	.93	.70
07	65	Alc.	Cig.	MJ	Glue	Other			
		37	31	20	9	3	.91	.80	.57
08	69	Alc.	Cig.	MJ	Other	Glue			
		22	17	10	4	1	.94	.89	.47
09	41	Alc.	Cig.	Glue	MJ	Other			
		24	20	5	5	0	.95	.89	.54
10	44	Alc.	Cig.	MJ	Glue	Other			
		39	30	27	5	0	.88	.80	.41
11	29	Alc.	Cig.	MJ	Glue	Other			
		34	21	10	3	0	.94	.86	.60
12	35	Alc.	Cig.	MJ	Glue	Other			
		29	23	11	6	6	.95	.85	.69
13	70	Alc.	Cig.	MJ	Glue	Other			
		31	29	14	3	1	.92	.84	.53
14	73	Alc.	Cig.	Glue	MJ	Other			
		38	16	10	7	0	.93	.86	.50

Table 1 (Continued)

School	N	Order and percent involved					Repro.	Min. repro.	Coef. scal.
15	61	Alc.	Cig.	MJ	Glue	Other			
		23	15	13	2	2	.93	.89	.33
16	183	Alc.	Cig.	Glue	MJ	Other			
		36	5	2	2	1	.98	.91	.79
17	63	Alc.	MJ	Cig.	Glue	Other			
		25	5	5	3	3	.97	.92	.62
18	21	Alc.	Cig.	MJ	Other	Glue			
		57	33	24	19	14	.94	.73	.78
19	24	Alc.	Glue	Cig.	MJ	Other			
		50	29	25	17	13	.92	.73	.69
20	77	Alc.	Glue	Cig.	MJ	Other			
		42	9	9	5	0	.95	.87	.60
21	97	Alc.	Cig.	MJ	Glue	Other			
		59	33	23	5	5	.92	.78	.65
22	71	Alc.	Cig.	MJ	Other	Glue			
		58	35	21	7	6	.93	.78	.70

Table 2

Percentages of Students Using Substances in Different Schools and Guttman Scale Analysis Results, Confirmatory Sample

School	N	Order and percent involved					Repro.	Min. repro.	Coef. scal.
01	106	Alc.	Cig.	MJ	Other	Glue			
		48	44	28	12	11	.92	.71	.71
02	101	Alc.	Cig.	MJ	Glue	Other			
		33	23	11	10	6	.91	.84	.44
03	66	Cig.	Alc.	MJ	Glue	Other			
		26	24	17	8	2	.92	.84	.48
04	42	Alc.	Cig.	Glue	MJ	Other			
		21	17	7	0	0	.94	.91	.37
05	31	Alc.	Cig.	MJ	Glue	Other			
		3	0	0	0	0	1.00	.99	1.00
06	54	Alc.	Cig.	MJ	Other	Glue			
		24	22	6	4	2	.95	.88	.55
07	66	Alc.	Cig.	MJ	Glue	Other			
		35	30	26	6	5	.88	.80	.43
08	72	Alc.	Cig.	MJ	Glue	Other			
		38	28	22	6	0	.94	.81	.67
09	37	Alc.	Cig.	Glue	MJ	Other			
		16	8	5	3	0	.96	.94	.33
10	46	Cig.	Alc.	MJ	Glue	Other			
		17	15	11	4	0	.92	.90	.18
11	31	Cig.	Alc.	MJ	Glue	Other			
		42	39	19	6	0	.92	.79	.64
12	36	Alc.	MJ	Cig.	Glue	Other			
		17	14	11	6	6	.92	.89	.26
13	67	Alc.	Cig.	MJ	Glue	Other			
		24	13	6	3	1	.95	.90	.50
14	64	Alc.	Cig.	MJ	Glue	Other			
		27	19	13	6	0	.93	.87	.46

Table 2 (Continued)

School	N	Order and percent involved					Repro.	Min. repro.	Coef. scal.
15	64	Alc.	Cig.	MJ	Other	Glue			
		30	17	14	3	2	.94	.87	.52
16	185	Alc.	Cig.	MJ	Other	Glue			
		36	5	2	2	1	.98	.91	.81
17	69	Alc.	Cig.	MJ	Glue	Other			
		29	7	3	1	1	.99	.92	.93
18	26	Alc.	MJ	Cig.	Other	Glue			
		62	54	19	19	12	.91	.73	.66
19	25	Alc.	Cig.	Glue	MJ	Other			
		36	24	16	8	8	.94	.82	.65
20	69	Alc.	MJ	Cig.	Glue	Other			
		35	9	7	4	0	.95	.89	.58
21	97	Alc.	Cig.	MJ	Other	Glue			
		55	34	21	7	6	.95	.77	.78
22	74	Alc.	Cig.	MJ	Glue	Other			
		58	30	28	8	7	.90	.77	.58

Table 3

Guttman Scale Statistics for a Constrained Sequence of "Stages" (Confirmation Sample)

School	N	Reproducibility	Minimum reproducibility	Coefficient of scalability
01	106	.90	.71	.67
02	101	.91	.84	.44
03	66	.93	.85	.56
04	42	.94	.91	.37
05	31	1.00	.99	1.00
06	54	.94	.88	.48
07	66	.88	.80	.43
08	72	.94	.81	.67
09	37	.97	.94	.50
10	46	.90	.90	.00
11	31	.91	.79	.58
12	36	.90	.89	.05
13	67	.95	.90	.50
14	64	.93	.87	.46
15	64	.93	.87	.48
16	185	.99	.91	.88
17	69	.99	.92	.93
18	69	.95	.89	.58
19	26	.89	.73	.60
20	25	.94	.82	.65
21	97	.93	.77	.69
22	74	.90	.77	.58

Table 4

Guttman Scale Statistics for Exploratory and Confirmatory Sample Schools

Sample and statistic	Lowest	Q1	Median	Q3	Highest
Exploratory (unconstrained)					
Reproducibility	.88	.92	.93	.95	.98
Minimum reproduc.	.73	.79	.84	.89	.93
Scalability	.33	.52	.61	.69	.79
Confirmatory (constrained)					
Reproducibility	.88	.90	.93	.94	1.00
Minimum reproduc.	.71	.80	.87	.90	.99
Scalability	.00	.45	.57	.66	1.00

Note. The ordering of the "stages" in the confirmatory sample was fixed to be alcohol, tobacco, marihuana, glue, other. In the exploratory sample the ordering that produced the highest reproducibility coefficient was used.

Table 6

Correlations of Drug Involvement Items with Composite Drug Involvement and Delinquency Scales: Exploratory Sample

Item	Percer endorsing	Correlation with: Drug	Delinq.
Males (N = 487)			
Drunk beer, wine, or "hard" liquor	36.3	.41	.39
Smoked cigarettes	16.0	.49	.39
Smoked marijuana	12.9	.55	.50
Sniffed glue, paint, or other spray	6.4	.30	.34
Gone to school drunk or high on drugs	5.5	.50	.45
Taken other drugs	4.3	.44	.38
Females (N = 626)			
Drunk beer, wine, or "hard" liquor	34.7	.36	.29
Smoked cigarettes	22.0	.47	.36
Smoked marijuana	11.3	.54	.32
Sniffed glue, paint, or other spray	4.0	.03	.09
Gone to school when drunk or high drugs	3.8	.41	.19
Taken other drugs	1.9	.35	.17

Note. Correlations for the drug composite are corrected for each item in turn.

Table 5

Alpha Reliabilities for Drug Involvement, Delinquency, and Other Scales

Scale	N items	Alpha Males	Alpha Females
Drug involvement	6	.69	.59
Delinquency	12	.82	.67
Truancy	2	.61	.62
School effort	5	.62	.56
Alienation	6	.60	.44
Attachment to school	10	.76	.75
Positive self-concept	12	.58	.60
Belief in conventional rules	6	.52	.54
Involvement	12	.60	.62
Interpersonal competency	5	.43	.47
Parental education	2	.76	.72

Note. Reliabilities for Drug Involvement and Delinquency were computed in the exploratory sample. Reliabilities for other measures are for related samples (Gottfredson, 1985; Gottfredson, Gottfredson, & Cook, 1983).

Table 7

Correlations of Drug Involvement Items with Composite Drug Involvement and Delinquency Scales: Confirmatory Sample

Item	Percent endorsing	Correlation with: Drug	Delinq.
Males (N = 509)			
Drunk beer, wine, or "hard" liquor	31.2	.42	.45
Smoked cigarettes	17.2	.49	.46
Smoked marijuana	12.6	.58	.54
Sniffed glue, paint, or other spray	5.2	.31	.32
Gone to school drunk or high on drugs	5.6	.50	.45
Taken other drugs	4.3	.41	.36
Females (N = 593)			
Drunk beer, wine, or "hard" liquor	29.4	.39	.35
Smoked cigarettes	19.8	.53	.42
Smoked marijuana	9.9	.61	.46
Sniffed glue, paint, or other spray	5.6	.06	.16
Gone to school when drunk or high drugs	2.8	.45	.35
Taken other drugs	1.6	.38	.32

Note. Correlations for the drug composite are corrected for each item in turn.

Table 8

Correlations of a Drug Involvement Scale with Other Personal Characteristics (Exploratory Sample)

Variable	Males	Females
Delinquency	.61	.43
Truancy	.33	.15
School effort	-.28	-.14
Alienation	.24	.17
Attachment to school	-.23	-.19
Positive self-concept	-.22	-.10
Ethnic self-identification = "white"	.15	.18
Belief in conventional rules	-.12	-.07
School grades	-.08	.04
Occupational aspiration level	.05	.03
Involvement	.01	.05
Interpersonal competency	.00	.09
Parental education	.00	.04

Note. N's for males range from 378 to 608 and for females range from 500 to 706.

Table 9

Increments to the Explanation of Seven Criterion Variables Due to Drug Involvement: Exploratory Sample Males

	Stage at which model is evaluated:					
	Background		Delinquency		Drug involvement	
Criterion variable	% Var.	Incr.	% Var.	Incr.	% Var.	Incr.
Listwise deletion for missing data (N = 148)						
Truancy	3.8	3.8	16.0	12.2***	21.6	5.6**
School effort	.1	.1	10.4	10.3***	11.5	1.1
Alienation	1.5	1.5	9.0	7.5***	9.0	.0
Attachment to school	1.1	1.1	20.5	19.4***	20.6	.1
Positive self-concept	4.3	4.3*	5.6	1.3	6.7	1.1
Belief in conv. rules	2.2	2.2	13.4	11.1***	13.4	.0
School grades	10.0	10.0**	10.1	.1	10.4	.4
Occupational aspiration	1.3	1.3	1.3	.0	1.6	.3
Pairwise deletion for missing data (N = 278 - 608)						
Truancy	3.3	3.3*	10.9	7.6***	15.0	4.1***
School effort	.4	.4	12.8	12.4***	13.4	.6
Alienation	1.1	1.1	10.3	9.2***	10.6	.3
Attachment to school	1.7	1.7	15.6	13.9***	15.6	.0
Positive self-concept	4.0	4.0**	9.7	5.7***	10.3	.6
Belief in conv. rules	1.4	1.4	8.4	7.0***	8.9	.5
School grades	4.8	4.8**	5.3	.5*	5.3	.0
Occupational aspiration	4.2	4.2**	4.7	.5	4.8	.0

* $p < .05$
** $p < .01$
*** $p < .001$

Table 10

Increments to the Explanation of Seven Criterion Variables Due to Drug Involvement: Exploratory Sample Females

Criterion variable	Stage at which model is evaluated: Background % Var.	Background Incr.	Delinquency % Var.	Delinquency Incr.	Drug involvement % Var.	Drug involvement Incr.
Listwise deletion for missing data (N = 272)						
Truancy	4.3	4.3*	6.0	1.7*	8.4	2.4**
School effort	.8	.8	8.2	7.4***	8.4	.2
Alienation	.3	.3	5.3	5.0***	6.3	1.0
Attachment to school	1.0	1.0	7.9	6.9***	8.4	.5
Positive self-concept	1.8	1.8	6.8	5.0***	6.9	.1
Belief in conv. rules	5.0	5.0*	8.9	3.9**	9.2	.3
School grades	5.9	5.9**	5.9	.0	6.0	.0
Occupational aspiration	1.4	1.4	2.1	.7	3.1	1.0
Pairwise deletion for missing data (N = 401 - 706)						
Truancy	4.8	4.8***	7.4	2.6***	8.6	1.2*
School effort	.1	.1	7.6	7.6***	7.7	.1
Alienation	.6	.6	4.6	4.0***	5.4	.8
Attachment to school	.5	.5	5.8	5.3***	6.8	.9*
Positive self-concept	2.7	2.7**	7.1	4.4***	7.1	.0
Belief in conv. rules	2.8	2.8*	7.2	4.3***	7.2	.0
School grades	3.6	3.6**	3.6	.0	3.7	.1
Occupational aspiration	1.4	1.4	2.1	.7	2.1	.0

* $p < .05$
** $p < .01$
*** $p < .001$

Table 11

Increments to the Explanation of Seven Criterion Variables Due to Drug Involvement: Confirmatory Sample Males and Females

	Stage at which model is evaluated:					
	Background		Delinquency		Drug involvement	
Criterion variable	% Var.	Incr.	% Var.	Incr.	% Var.	Incr.
Males (N = 184)						
Truancy	6.1	6.1*	16.4	10.3***	21.0	4.6**
School effort	1.8	1.8	11.8	10.0***	11.9	.1
Alienation	1.2	1.2	3.8	2.6*	4.4	.5
Attachment to school	2.7	2.7	17.0	14.3***	19.3	2.3*
Positive self-concept	3.4	3.4	6.5	3.1*	8.0	1.6
Belief in conv. rules	3.0	3.0	17.5	14.5***	17.8	.3
School grades	8.8	8.8**	9.0	.2	10.4	1.4
Occupational aspiration	2.8	2.8	4.4	1.6	4.4	.0
Females (N = 243)						
Truancy	6.3	6.3**	10.9	4.6***	13.4	7.0**
School effort	1.7	1.7	6.5	4.8***	8.0	1.5*
Alienation	.6	.6	4.7	3.1	8.4	3.7
Attachment to school	2.1	2.1	5.1	3.0**	9.7	4.6***
Positive self-concept	4.6	4.6**	5.6	1.0	5.6	.0
Belief in conv. rules	1.2	1.2	9.1	7.9***	10.2	1.1
School grades	2.9	2.9	2.9	.0	3.4	.5
Occupational aspiration	5.8	5.8**	6.2	.4	7.2	1.0

* $p < .05$
** $p < .01$
*** $p < .001$

Table 12

Correlations of Male Personal and Family Characteristics at Time 1 with Initiation into Marijuana Use: With and Without Incidental Selection on the Criterion

Time 1 Predictor	No selection M	SD	r with: MJ	Drug	Incidental selection M	SD	r with: MJ	Drug
Age	13.36	1.85	.13***	.12***	14.26	1.97	.08	.10
School grades	2.43	.91	-.09**	-.11***	2.47	.81	-.06	-.07
Reading ability	1.55	.90	-.02	-.01	1.66	.90	-.04	.01
Parental education	2.24	1.22	.05	.03	1.94	1.19	.24**	.15
Parental emp. educ.	.61	.28	-.18***	-.25***	.64	.28	-.10	-.18
Educational expt.	3.03	1.77	-.03	-.07*	3.00	1.74	.03	-.07
Attach. to parents	.65	.26	-.18***	-.19***	.63	.27	-.15*	-.19*
Neg. peer influence	.25	.20	.24***	.28***	.28	.23	.26***	.31***
Alienation	.34	.28	.13**	.16***	.30	.28	-.01	.07
Attachment to school	.67	.25	-.19***	-.29***	.66	.26	-.14	-.29***
Belief in conv. rules	.63	.24	-.14***	-.17***	.63	.26	-.29***	-.37***
Interpers. competency	.75	.23	.00	-.02	.74	.23	.15	.18*
Involvement	.22	.18	-.08*	-.10**	.20	.16	-.14	-.12
Pos. self-concept	.68	.18	-.08	-.14***	.66	.18	-.03	-.10
Rebellious autonomy	.61	.33	.13***	.18***	.63	.36	.21*	.31***
School effort	.58	.28	-.20***	-.24***	.56	.29	-.23**	-.22**
Truancy	.35	.40	.15***	.22***	.54	.41	.09	.15*
School punishment	.27	.28	.14***	.17***	.25	.28	.23**	.19**
School rewards	.31	.30	-.11**	-.13***	.29	.29	-.28***	-.25***
Victimization	.18	.22	.04	.07*	.16	.20	-.10	-.04
Delinquency	.13	.17	.30***	.32***	.21	.20	.20**	.20**
Time 2								
Marijuana use	.28	.45			.41	.49		
Drug involvement	.23	.27			.25	.29		

Note. Incidental selection on the criterion variable is by including only persons who reported tobacco or alcohol use the previous year.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 13

Correlations of Female Personal and Family Characteristics at Time 1 with Initiation into Marijuana Use: With and Without Incidental Selection on the Criterion

Time 1 Predictor	No selection M	SD	r with: MJ	Drug	Incidental selection M	SD	r with: MJ	Drug
Age	13.34	1.80	.07*	.05	13.89	1.76	-.04	-.07
School grades	2.65	.94	-.02	-.03	2.59	.86	-.08	-.10
Reading ability	1.61	.85	-.03	-.04	1.67	.82	-.04	-.06
Parental education	2.09	1.24	.08*	.13***	1.97	1.15	.21**	.24***
Parental emp. educ.	.65	.26	-.05	-.09	.61	.27	.08	.07
Educational expt.	3.38	1.76	.03	-.01	3.27	1.72	.01	-.09
Attach. to parents	.65	.26	-.18***	-.20***	.57	.27	-.22***	-.21***
Neg. peer influence	.18	.18	.27***	.30***	.22	.20	.32***	.37***
Alienation	.29	.28	.05	.08**	.31	.29	.01	.02
Attachment to school	.76	.22	-.15***	-.21***	.70	.24	-.09	-.14*
Belief in conv. rules	.71	.22	-.04	-.05	.70	.22	-.11	-.14*
Interpers. competency	.78	.21	-.07*	.05	.79	.20	.07	.06
Involvement	.26	.18	-.03	-.05	.24	.19	-.03	-.09
Pos. self-concept	.75	.17	-.07*	-.12***	.71	.18	-.07	-.12
Rebellious autonomy	.56	.35	.18***	.21***	.63	.32	.22**	.24***
School effort	.68	.68	-.10**	-.13***	.66	.28	-.05	-.11
Truancy	.29	.38	.14***	.13***	.41	.41	.08	.09
School punishment	.16	.23	.10***	.13***	.20	.24	.18**	.16**
School rewards	.31	.31	-.09**	-.11***	.31	.31	-.09	-.12*
Victimization	.10	.16	.02	.05	.13	.17	-.05	-.06
Delinquency	.06	.11	.28***	.29***	.11	.14	.21***	.20**
Time 2								
Marijuana use	.19	.39			.34	.47		
Drug involvement	.18	.24			.30	.28		

Note. Incidental selection on the criterion variable is by including only persons who reported tobacco or alcohol use the previous year.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 14

Tests for Homogeneity of Regression of Initiation to Marijuana Use at Time 2 on a Range of Predictors for Males Who Had and Had Not Initiated Alcohol or Tobacco Use at Time 1

Time 1 Predictor	Proportion of variance with: No interaction	Proportion of variance with: Interaction	F for increment	df 1 and
Age	.12	.12	.12	407
School grades	.13	.13	.23	404
Reading ability	.12	.12	.02	385
Parental education	.12	.14	9.11**	285
Parental emp. educ.	.14	.19	14.42***	208
Educational expt.	.11	.12	.82	393
Attach. to parents	.13	.13	.78	340
Neg. peer influence	.14	.15	2.22	386
Alienation	.13	.14	5.66*	346
Attachment to school	.14	.14	.19	369
Belief in conv. rule	.13	.14	6.03*	338
Inter. competency	.11	.13	5.80*	284
Involvement	.12	.13	5.08*	307
Pos. self-concept	.12	.14	7.42**	312
Rebellious autonomy	.12	.15	8.13**	269
School effort	.14	.16	8.58**	336
Truancy	.12	.12	.25	396
School punishment	.13	.14	8.03**	380
School rewards	.12	.17	22.43***	381
Victimization	.11	.13	7.91**	374
Delinquency	.14	.15	3.28	378

Note. The statistical test is for the increment to R-squared when an interaction term is added to a prediction equation including initition to alcohol or tobaco use and each of the other predictors in turn.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 15

Tests for Homogeneity of Regression of Initiation to Marijuana Use at Time 2 on a Range of Predictors for Females Who Had and Had Not Initiated Alcohol or Tobacco Use at Time 1

Time 1 Predictor	Proportion of variance with: No interaction	Proportion of variance with: Interaction	F for increment	df 1 and
Age	.12	.12	4.46**	571
School grades	.12	.12	1.32	567
Reading ability	.12	.12	.22	533
Parental education	.12	.14	12.21***	404
Parental emp. educ.	.12	.12	.80	305
Educational expt.	.12	.12	.01	557
Attach. to parents	.12	.16	18.31***	493
Neg. peer influence	.15	.18	18.09	553
Alienation	.12	.12	.51	511
Attachment to school	.12	.12	1.54	543
Belief in conv. rule	.12	.14	13.73***	496
Inter. competency	.12	.13	7.54**	433
Involvement	.12	.12	.26	453
Pos. self-concept	.12	.13	5.71*	468
Rebellious autonomy	.13	.13	2.42	416
School effort	.12	.12	.18	475
Truancy	.12	.12	.00	559
School punishment	.12	.15	19.73***	547
School rewards	.12	.12	.70	546
Victimization	.12	.12	.68	546
Delinquency	.15	.15	.00	545

Note. The statistical test is for the increment to R-squared when an interaction term is added to a prediction equation including initition to alcohol or tobaco use and each of the other predictors in turn.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 16

Regression of Time 2 Marijuana Use on Time 1 Predictors and Squares of Predictors

Group and predictor	beta for Predictor	beta for Predictor squared
Males (n = 532 - 801)		
Parental education	.35**	-.31*
Belief in conventional rules	-.14***	ns
Interpersonal competency	ns	ns
Positive self-concept	.57*	-.66**
School punishment	.39***	-.27**
Females (n = 656 - 987)		
Parental education	.46***	-.40**
Belief in conventional rules	ns	ns
Interpersonal competency	ns	.07*
Positive self-concept	-.07*	ns
School punishment	.37***	-.29***

* $p < .05$
** $p < .01$
*** $p < .001$

Table 17

Marijuana Use at Time 2 and Time 3 According to Level of Parental Education Measured a Year Earlier in Four Samples

Interval and score for parental education	Marijuana use					
	Males			Females		
	M	SD	n	M	SD	n
Year 01 to year 02						
1 (Lowest)	.28	.45	420	.16	.37	485
2	.18	.38	62	.21	.41	77
3	.36	.49	36	.21	.41	53
4	.32	.47	144	.21	.41	179
5	.32	.47	31	.32	.47	41
6	.20	.40	66	.23	.43	77
7	.41	.50	29	.22	.42	31
8 (Highest)	.24	.43	97	.17	.38	95
Year 02 to year 03						
1 (Lowest)	.20	.40	111	.13	.33	155
2	.33	.48	45	.17	.38	63
3	.42	.50	31	.09	.30	32
4	.25	.44	80	.24	.43	99
5	.25	.44	20	.31	.47	26
6	.28	.45	40	.24	.44	37
7	.71	.47	14	.16	.37	19
8 (Highest)	.20	.40	46	.21	.41	53

Note. The parental education scale ranging from 0 to 4 was divided into eight intervals, each 0.5 wide.

Table 18

Marijuana Use at Time 2 and Time 3 According to Level of Belief in Conventional Rules Measured a Year Earlier in Four Samples

Interval and score for Belief scale	Marijuana use					
	Males			Females		
	M	SD	n	M	SD	n
Year 01 to year 02						
1 (Lowest)	.26	.44	219	.19	.40	166
2	.43	.50	103	.18	.38	57
3	.24	.43	150	.23	.42	152
4	.32	.47	192	.22	.41	252
5 (Highest)	.21	.41	221	.16	.36	411
Year 02 to year 03						
1 (Lowest)	.24	.43	87	.14	.35	63
2	.37	.49	27	.32	.48	31
3	.37	.49	59	.30	.46	61
4	.33	.47	87	.16	.37	120
5 (Highest)	.18	.39	127	.16	.36	209

Note. The belief scale, ranging from 0 to 1 was divided into five intervals, each 0.2 wide.

Table 19

Marijuana Use at Time 2 and Time 3 According to Level of Interpersonal Competency Measured a Year Earlier in Four Samples

Interval and score for Interpersonal Competency	Marijuana use					
	Males			Females		
	M	SD	n	M	SD	n
Year 01 to year 02						
1 (Lowest)	.23	.42	255	.21	.41	221
2	.26	.44	68	.15	.36	59
3	.31	.47	143	.14	.35	143
4	.29	.45	211	.19	.39	317
5 (Highest)	.30	.46	208	.21	.41	298
Year 02 to year 03						
1 (Lowest)	.25	.43	97	.14	.34	66
2	.30	.46	27	.16	.37	31
3	.25	.44	59	.18	.38	68
4	.28	.45	105	.15	.36	158
5 (Highest)	.28	.45	99	.24	.43	161

Note. The Interpersonal Competency scale, ranging from 0 to 1 was divided into five intervals, each 0.2 wide.

Table 20

Marijuana Use at Time 2 and Time 3 According to Level of Positive Self-Concept Measured a Year Earlier in Four Samples

Interval and score for Self-Concept	Marijuana use					
	Males			Females		
	M	SD	n	M	SD	n
Year 01 to year 02						
1 (Lowest)	.24	.42	258	.19	.39	190
2	.13	.34	39	.28	.46	18
3	.38	.49	174	.22	.42	149
4	.31	.46	236	.20	.40	293
5 (Highest)	.22	.41	178	.16	.37	388
Year 02 to year 03						
1 (Lowest)	.22	.42	96	.15	.36	79
2	.33	.50	9	.33	.50	9
3	.34	.48	64	.14	.35	44
4	.29	.46	106	.22	.42	155
5 (Highest)	.25	.44	112	.17	.37	197

Note. The Positive Self-Concept scale, ranging from 0 to 1 was divided into five intervals, each 0.2 wide.

Table 21

Marijuana Use at Time 2 and Time 3 According to Level of School Punishment Measured a Year Earlier in Four Samples

Interval and score for School Punishment	Marijuana use					
	Males			Females		
	M	SD	n	M	SD	n
Year 01 to year 02						
1 (Lowest)	.24	.43	634	.17	.38	866
2	.37	.48	143	.34	.48	112
3	.40	.49	83	.17	.38	52
4 (Highest)	.24	.44	25	.12	.35	8
Year 02 to year 03						
1 (Lowest)	.25	.43	283	.16	.36	421
2	.26	.44	54	.33	.48	45
3	.42	.50	36	.41	.51	17
4 (Highest)	.36	.50	14	1.00	.00	1

Note. The School Punishment scale, ranging from 0 to 1 was divided into four intervals, each 0.25 wide.

Table 22

Percentage of Variance in Individual Drug Involvement Between Schools

Sample	%	F	df
Exploratory			
Male	5.9*	2.41	13,500
Female	12.6**	6.63	14,644
Confirmatory			
Male	13.2**	5.79	14,533
Female	10.8**	5.30	14,614

* $p < .05$
** $p < .001$

Table 23

Validity of Drug Involvement Propensity Composite in Exploratory and Confirmatory Samples

Composite and sample	r	n
Composite developed in exploratory sample in exploratory sample		
Male	.65	368
Female	.52	514
Composite developed in exploratory sample in confirmatory sample		
Male	.69	482
Female	.60	577
Composite developed in confirmatory sample in confirmatory sample		
Male	.70	482
Female	.61	577

Table 24

Multi-Level Equations for Drug Involvement Using Individual Differences in Propensity and Drug Availability in the School as Explanatory Variables

Sample	Individual propensity b	Individual propensity SE(b)	School drug availability scale b	School drug availability scale SE(b)	Constant
Exploratory					
Males	.961	(.059)	.022	(.069)	-.004
Females	.758	(.064)	.133	(.089)	-.002
Confirmatory					
Males	1.120	(.059)	.191	(.104)	-.052
Females	1.044	(.062)	.237	(.122)	-.042

Note. Regression coefficients for individual propensity were estimated using the pooled within school covariance matrix, as are the standard errors for those coefficients. Regression coefficients and standard errors for school effects of drug availability were estimated using a between schools model with drug use adjusted for the compositional effects of individual propensity to drug involvement estimated from the pooled within school individual-level model. Regression coefficienits greater than 1.96 times their standard error are significant at the $p < .05$ level. All coefficients for individual propensity are highly significant, coefficients for availability in the confirmatory (but not exploratory samples) approach significance, with coefficients 1.83 and 1.94 times their standard errors for males and females, respectively.

Table 25

Multi-Level Equations for Drug Involvement Using Individual Differences in Propensity and Reports that it is Easy to Buy Drugs in the School as Explanatory Variables

Sample	Individual propensity b	Individual propensity SE(b)	Proportion reporting easy to buy drugs b	Proportion reporting easy to buy drugs SE(b)		Constant
Exploratory						
Males	.961	(.059)	.336	(.427)		-.006
Females	.758	(.064)	1.378	(.478)	*	-.002
Confirmatory						
Males	1.120	(.059)	1.164	(.345)	**	-.033
Females	1.044	(.062)	1.648	(.317)	***	-.023

Note. Regression coefficients for individual propensity were estimated using the pooled within school covariance matrix, as are the standard errors for those coefficients. Regression coefficients and standard errors for school effects of drug availability were estimated using a between schools model with drug use adjusted for the compositional effects of individual propensity to drug involvement estimated from the pooled within school individual-level model. All coefficients for individual propensity are highly significant. Significance levels for school effects are indicated by asterisks.

* $p < .025$ ** $p < .01$ *** $p < .001$